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PALEONTOLOGY.—*Early Tertiary species of gastropods from the Isthmus of Tehuantepec.*[1] JULIA GARDNER, U. S. Geological Survey and EDGAR BOWLES, Johns Hopkins University.

Among some collections made in Mexico a number of years ago, was a small gastropod assemblage of four species, all of them unfamiliar. They had nothing in common with any known East Coast or Gulf fauna and were put aside in the hope that at some future time check material might come to light. A few months ago, in a random survey of the Federal collections, Mr. F. E. Turner of the University of California came upon them and commented on their extraordinary resemblance to middle Eocene (Domengine) species from the Simi Valley in southern California. A closer comparison further revealed the faunal similarity which is the more significant because the species are not generalized but are apparently specialized and short ranging types. Although certain elements in the Domengine fauna are present in the Umpqua formation of Oregon, there is no former record of the extension of the Domengine sea south of California. So close, however, is the resemblance between the Chiapas faunule and that from the Simi Valley, distant more than 1700 miles in an air line, that a common shore line may be reasonably postulated.

The Chiapas locality is about 12 miles east-north-east of Sayula and less than 10 miles behind the mountain front which faces the Atlantic Ocean. There is no evidence in the present material that the Atlantic had broken through, but the inter-oceanic barrier must have been extremely narrow.

The sketch map (Fig. 1) indicates the outcrop from which the collection was made.

[1] Published by permission of the Director, U. S. Geological Survey. Received March 5, 1934.

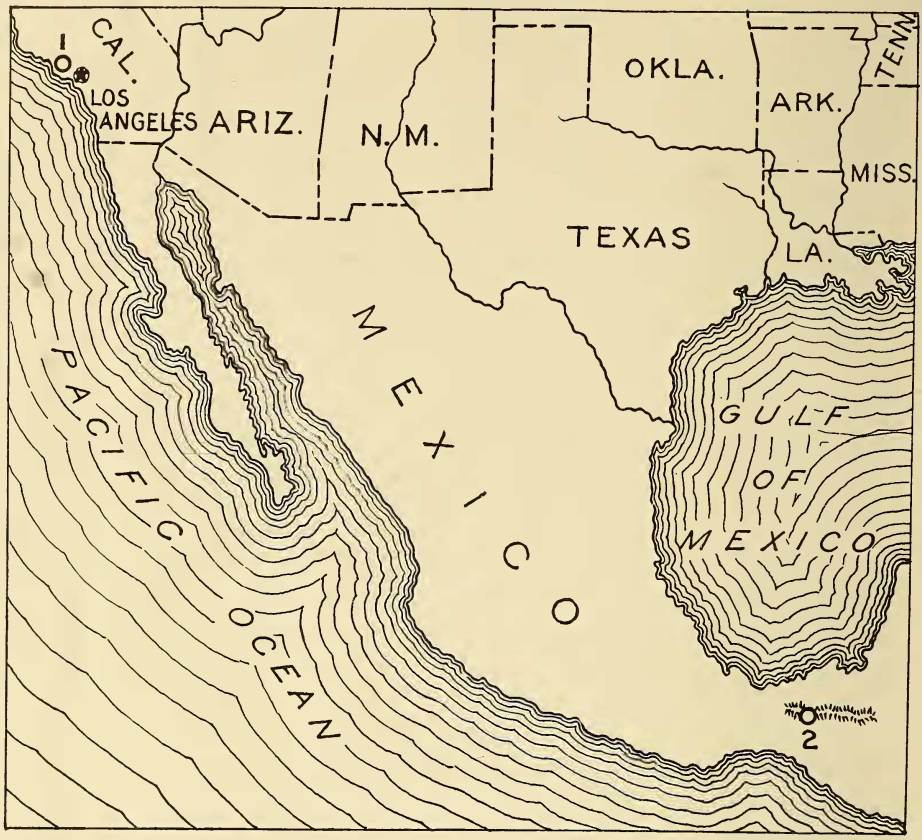


Fig. 1.—Locality 1—Simi Valley, California; 2—12 miles east-north-east Sayula, Chiapas, Mexico.

AMPULLINAE

Cernina Gray

1840. Gray, J. E. Syn. Cont. Brit. Mus., **42**: 147.

Type: *Natica fluctuata* G. B. Sowerby (Recent in the south Pacific).

The type of *Cernina* is a large, not very heavy, inflated shell with a depressed spire and with a widely expanded and obliquely produced aperture. The inner margin of the aperture is broadly constricted at the base of the body. The parietal callous is very heavy but thins gradually and is spread over the body wall with no sharply defined limit excepting at the extreme anterior portion where it merges into the sharp, narrowly reverted, anterior margin of the aperture. The genotype is the only living representative of a family which was widespread during the first half of the Tertiary, both in

the Tethyan sea and in the cooler waters. Stewart[2] in his discussion of the Ampullinae recognized the need of a new group name to include *"Natica" hannibali* Dickerson: *"Globularia hannabali* Dickerson might be cited as an Eocene *Cernina* but it has a much heavier callous extending over the parietal region with a distinct boundary. I think it will prove to represent a separate group of *Globularia*, not directly related to *Cernina*, the latter having probably developed from Globularia in the Miocene or later." The importance of the group is increased by the recognition of an allied member many hundred miles to the south of the form described by Dickerson.

EOCERNINA Gardner and Bowles, new section

Type: *Natica hannabali* Dickerson. Middle Eocene (Umpqua formation) of Oregon.

Shell heavy; obliquely ovate. Spire depressed. Nucleus not preserved but certainly small and paucispiral. Post nuclear whorls increasing very rapidly in diameter. Aperture pyriform, expanded and obliquely produced anteriorly, the line of division between the outer lip and the parietal callous indicated by a shallow groove. Parietal callous heavy with a sharply defined outer limit, almost or entirely sealing the umbilicus and merging into the slightly reverted anterior margin of the aperture. Sculpture restricted to incrementals with occasional resting stages.

The section is founded upon the type species from the Umpqua formation of Oregon and its variants in the Domengine formation of southern California and a new species from the Isthmus of Tehuantepec.

Ampullina sphaerica Deshayes from the upper Eocene of the Paris Basin shares with the American forms the depressed spire, heavy shell, and parietal callous.

Cernina (Eocernina) **chiapasensis** Gardner and Bowles, n. sp.
Fig. 2, 3.

Shell subglobose, smoothly inflated; spire depressed. Nuclear whorls not preserved but doubtless small in size and few in number. Post-nuclear whorls 4 to 5, increasing rapidly in diameter; body whorl largely enveloping the earlier volutions, inflated, obtusely shouldered. Sculpture consisting only of fine incremental lines, most evident on the body whorl. Sutures regular, clearly defined, and deeply impressed. Aperture wide and flaring, anteriorly produced. Parietal callous heavy. Umbilicus almost or entirely covered by the encroaching callous.

Dimensions: Height, 36 millimeters; greatest diameter, 38±millimeters (aperture of specimen incomplete).

Holotype: U. S. National Museum No. 373046.

Paratype: U. S. National Museum No. 373047.

Type locality: U. S. Geol. Survey Sta. No. 13230, about 12 miles east-north-east of Sayula, Chiapas, Mexico. Eocene.

The closest analogue of this species is *Ampullina hannibali* Dickerson[3] from

[2] STEWART, R. B. Acad. Nat. Sci. Philadelphia, Proc. **78**: 331. 1926.

[3] DICKERSON, R. E. California Acad. Sci. Proc., ser. 4, **1**: no. 4, p. 119. *pl. 12, figs. 5a, 5b.* 1914. (as *Natica hannibali*).

the middle Eocene (Umpqua formation) of Oregon, and the variants in the Domingine of the Simi Valley, California. The West Coast species differs from *A. chiapasensis*, however, in its less inflated and more obliquely shouldered body whorl; its higher spire; its more flaring aperture; and the heavier callous which completely seals the umbilicus. The apparent perforation in the umbilicus of the holotype is, however, increased by the broken margin of the callous.

Cerina chiapasensis is represented by the holotype and a smaller paratype, measuring 28 millimeters in height and 26.5 millimeters in maximum diameter.

Amaurellina "Bayle" Fischer 1885

1885. Fischer, Paul, Manuel de Conchyliologie. 8: 766. 1885..

Type by monotypy: *Ampullaria spirata* Lamarck. Eocene of the Paris Basin.

Amaurellina malinchae Gardner and Bowles, n. sp.

Fig. 5.

Shell of medium size. Spire more than one-third as high as the entire shell; scalariform. Nuclear whorls not well preserved or clearly differentiated from the conch. Post-nuclear whorls probably 5 in number, regularly increasing in size, those of the spire rudely trapezoidal in outline. Body whorl angular posteriorly, elongated and tapering anteriorly. Shoulders sharply carinate, sloping inward from the pinched and elevated keel to the distinct but not conspicuous sutures; space between the suture and the keel irregularly threaded with about 8 spiral lirae overridden by fine, crowded incremental laminae. Aperture crushed in the type but apparently long and narrow, anteriorly produced. Parietal callous heavy, almost—and possibly in a perfect specimen, entirely—sealing the umbilicus, merging into the margin of the outer lip.

Dimensions: Height, 39 millimeters; greatest diameter, 24 millimeters.

Holotype: U. S. National Museum No. 373050.

Type locality: U. S. Geol. Survey Sta. No. 13230, about 12 miles east-north-east of Sayula, Chiapas, Mexico. Eocene.

Amaurellina moragai Stewart[4] from the Tejon of California is more inflated and more ovate in form, and the whorls are less sharply angulated. *Amaurellina moragai lajollaensis* Stewart,[5] from the Domengine horizon is less inflated than the Tejon form, but the whorls are not so sharply keeled as in *A. malinchae*. *Amaurellina malinchae* is known only from the holotype.

Amaurellina cortezi Gardner and Bowles, n. sp.

Figs. 7, 9.

Shell heavy, squat-ovate; spire moderately high for the group, obtusely scalariform. Whorls about 6 in number, regularly increasing in size, obtusely shouldered. Sutures distinct, impressed. Shell smooth excepting for an in-

[4] Stewart, R. B. Op. cit. 334. *pl. 18, fig. 3.*
[5] Stewart, R. B. Op. cit. 335. *pl. 28, fig. 2.*

cremental sculpture which is unusually strong, sharp, and regular. Aperture semilunate; outer lip entire. Inner wall covered by a heavy callous completely sealing the umbilical opening.

Dimensions: Height, 32.5 millimeters; greatest diameter, 27.0 millimeters.
Holotype: U. S. National Museum No. 373048.
Paratypes: U. S. National Museum No. 373049.
Type locality: U. S. Geol. Survey Sta. No. 13230, about 12 miles east-north-east of Sayula, Chiapas, Mexico. Eocene.

There are 18 paratypes of this species in the Chiapas collection. Many of these are broken or poorly preserved and the largest is 46 millimeters high. *Amaurellina clarki* Stewart,[6] so abundant in the Domengine of the Simi Valley, differs from *A. cortezi* in the relatively higher and more turrited spire, the less inflated and more produced body whorl and the less expanded aperture.

VOLUTIDAE

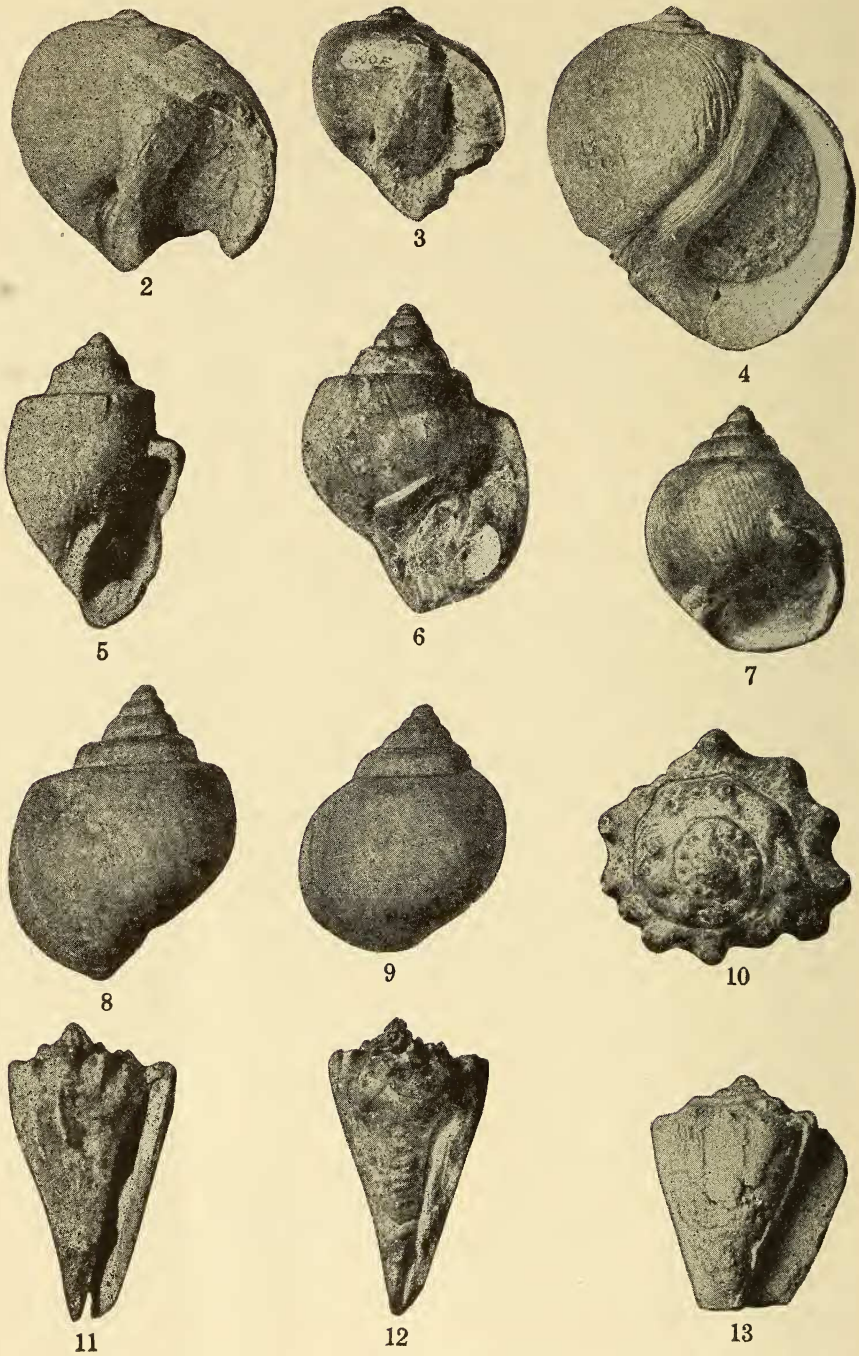
Volutocristata Gardner and Bowles, n. gen.

Genotype: *Volutocristata chiapasensis* Gardner and Bowles. Middle Eocene of Chiapas, Mexico.

Shell coniform; spire depressed but the apex a rather prominent boss; nuclear whorls not well preserved, but certainly small and few in number; post nuclear whorls about 5 in the genotype, the later whorls wound close to the tubercled periphery of the preceding volution; body conic, slightly concave laterally; abruptly shouldered; apical surface ornately sculptured; early whorls with 11 to 13 prominent axial ribs which on the later whorls are reduced to erect peripheral tubercles evanescing on the body within the posterior third; incremental striae crowded and rather sharp; axial sculpture overridden by fine, crowded, somewhat irregular lirae; base of body obliquely sulcate, the grooves more closely spaced anteriorly; sutures distinct, undulated by the peripheral nodes of the preceding volution; aperture narrow, elongate with subparallel margins; outer lip entire with a simple, bevelled edge; columellar wall plicate, the anterior fold the strongest and the most oblique, the 4 or 5 behind it less sharply defined and irregular in size and spacing and almost at right angles to the axis of the shell; all of the folds deep-seated and visible only in the broken shell or in moulds; parietal callous heavy, washed backward over the preceding volution in the adult whorls; anterior fasciole narrow, the terminal notch shallow.

This genus has been erected to accommodate two similar and remarkable volutes, *Plejona lajollaensis* Hanna[7] from the Domengine (middle Eocene) of California and *Volutocristata chiapasensis*, the genotype, from the Isthmus of Tehuantepec. They are characterized by the conspicuously coniform outline, depressed spire, crested periphery and the very narrow aperture with sub-parallel margins.

[6] STEWART, R. B. Op. cit. 336. *pl. 26, figs. 8, 9.*
[7] HANNA, M. A. Univ. California Dept. Geology, Bull. **16**: no. 8, p. 320. *pl. 52, figs. 1, 2.* 1927. "*Pejona*" by typographical error.



Figs. 2–13.—For explanation see opposite page.

The genus *Volutoconus* of Crosse[8] though suggesting a coniform shell includes species with a more typically volutoid aperture, rounded shoulders and an oliviform rather than coniform outline.

The form most closely resembling *Volutocristata* pictorially is *Diploconus crassus* Douvillé[9] from the *Cardita beaumonti* beds of northern India.

The genus *Diploconus* was erected by Douvillé[10] to cover two species, the genotype *D. elegans*, a relatively high-spired form, and *D. crassus*. *Diploconus* was referred to the Fusidae in which Douvillé included *Turbinella*, but in his discussion, he emphasized the characters common to the Strombidae and recognized in *Diploconus* an indicator of a common ancestry for the fusids and strombs. Douvillé's figures suggest that the outer lip in adult *Diploconus* is pulled slightly backward over the preceding whorl as it is in the strombs, but this is not true of the American forms and may not be true of the Indian, for the material figured by Douvillé is mostly in the form of incomplete moulds. The columellar folds of the Indian species seem stronger and more oblique but this difference is probably more apparent than real for the folds of the American species are deep seated and can be adequately observed only in the broken shell. No genetic relationship between the Indian and American faunas can be surely established on the material available, but such a relationship is a possibility of unusual interest as it involves the early migration routes of the Tethyan faunas. The Tethyan, the ancestral Mediterranean, sea was presumably closed on the west by the "Cathaysia" of Grabau, and was thus isolated from the equatorial Pacific, though it may have been open to the Atlantic by way of northern Africa. Forms similar to *Diploconus* are unknown in either the fossil or the Recent Japanese faunas.

Among the American volutes, the closest relationship may perhaps be found with *Volutocorbis* Dall, a group remarkably prolific in the American Eocene. Variants of the genotype, *Volutilithes limopsis* Conrad from the

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Fig. 2–3. *Cernina* (*Eocernina*) *chiapasensis* Gardner and Bowles. 2. Apertural view of holotype, ×1. 3. Apertural view of paratype, ×1. Fig. 4. *C.* (*Eocernina*) species cf. *C. hannabali* (Dickerson) from the Simi Valley,[11] California. Apertural view, ×1. Fig. 5. *Amaurellina malinchae* Gardner and Bowles. Apertural view of holotype, ×1. Fig. 6. *A. clarki* Stewart from the Simi Valley, California. Apertural view, ×1. Fig. 7. *A. cortezi* Gardner and Bowles. Apertural view of holotype, ×1. Fig. 8. *A. clarki* Stewart from the Simi Valley, California. Rear view of individual shown in Figure 5, ×1. Fig. 9. *A. cortezi* Gardner and Bowles. Rear view of individual shown in Figure 6, ×1. Fig. 10–12. *Volutocristata chiapasensis* Gardner and Bowles. 10. Apical view of paratype, ×1. 11. Apertural view of holotype, ×1. 12. Apertural view of holotype broken to expose columellar plications, ×1. Fig. 13. *V. lajollaensis* (Hanna) from the Simi Valley, California. Apertural view, ×1.

[8] CROSSE, H. JOUR. DE CONCHYL., ser. 3, 19: 306. 1871.

[9] DOUVILLÉ, HENRI. *Les Couches a* Cardita Beaumonti. Geol. Survey of India, Mem., Paleontologia Indica, new ser., 10: 38, *pl. 7, figs. 8, 9.* 1929.

[10] Idem., p. 136.

[11] All of the specimens from the Simi Valley are from U. S. Geol. Survey Sta. No. 12632, collected by W. P. Woodring on the north side of the Simi Valley, on the east side of Las Llajas Canyon, 6850 feet South 17½° East from Bench Mark 2165, Ventura County, California.

Gulf Eocene, are widespread in the lower Claiborne of Texas and northern Mexico. There are numerous obvious differences between the genera, the most significant, perhaps, being the more regular and stronger plications upon the pillar of *Volutocorbis*, which unlike those of *Volutocristata*, emerge at the aperture. In *Volutocorbis*, however, as in *Volutocristata*, the parietal wash is extended backward upon the preceding whorl in adult individuals, and the two groups are similar in the direction of the growth lines, the grooving upon the base of the body, the characters of the anterior fasciole, and the general sculpture pattern.

Volutocristata chiapasensis Gardner and Bowles, n. sp.

Figs. 10–12

Shell of moderate dimensions and rather heavy, coniform. Spire depressed but the apex a prominent boss. Body elongate-conic, gently tapering and slightly concave, laterally. Nuclear whorls imperfectly preserved and differentiated but certainly small and few in number. Post-nuclear whorls about 5, rapidly increasing in size, conspicuously shouldered. Post-nuclear axial sculpture gradually changing from narrow ribs continuous from suture to suture on the early whorls to prominent peripheral nodes on the later, the number running from 11 to 13 to the whorl; fine spiral striae superposed upon the axials, strongest relatively and most regular upon the early volutions; base of body obliquely sulcate, the grooves more closely spaced anteriorly; sutures incised, undulated by the axials of the preceding whorl. Aperture narrow, the margins sub-parallel. Outer lip simple, the edge bevelled. Pillar wall plicate, the folds deep seated and not emergent at the aperture; anterior fold the strongest and the most oblique; the 4 or 5 folds behind it irregular and approximately at right angles to the axis of the shell. Parietal wash moderately heavy, transgressing the shoulder on the last two volutions and partially overriding the peripheral nodes. Anterior fasciole narrow and inconspicuous; the terminal notch very shallow.

Dimensions: Height, 39.5 millimeters; greatest diameter, 23.5 millimeters.

Holotype: U. S. National Museum No. 373044.

Paratype: U. S. National Museum No. 373045.

Type locality: U. S. Geol Survey Sta. No. 13230.

Volutocristata chiapasensis is represented by the holotype and a broken paratype consisting of the apical portion only. The maximum diameter of the paratype is 34 millimeters and the axial nodes total 55 or 56. *Volutocristata lajollaensis* (Hanna) from the Domengine of southern California is the only known American species remotely resembling specifically our Mexican form. It differs in the relatively broader body whorl; the less sharply angulated keel; the less prominently elevated but more acute peripheral nodes; the more posterior suture which follows closely the periphery of the later whorls rather than falling a little in front of the periphery as it does in *V. chiapasensis;* and the sharper, more uniform and more regularly spaced columellar plications.